REJ10J1217-0100

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M16C R8C FoUSB/UART Debugger

User's Manual

RENESAS MICROCOMPUTER Development Environment System
M16C Family R8C/Tiny Series
Precautions on Connecting R8C/20, R8C/21, R8C/22, R8C/23

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Table of Contents

1. Connection with User System 4
2. Prepare M16C R8C FoUSB/UART emulator debugger 5
3. Memory Map When Using R8C UART Debugger 17
4. Occupied Area for Monitor Program 18
5. Precautions on Using R8C UART Debugger 18
   5.1. When changing the communication speed and restarting the R8C UART debugger after the R8C UART debugger ends 18
   5.2. ID code of user program 18
   5.3. Area in which user program can be downloaded 19
   5.4. Frequency characteristics 19
   5.5. Limitations on SFR operation 20
   5.6. Limitations on stop mode or wait mode 20
   5.7. Watchdog timer 20
   5.8. Real-time operation of user program 21
   5.9. Exceptional step execution 22
   5.10. Limitations on peripheral functions 23
   5.11. Limitations on flag register 23
   5.12. Operation on peripheral I/O during break 23

1. Connection with User System

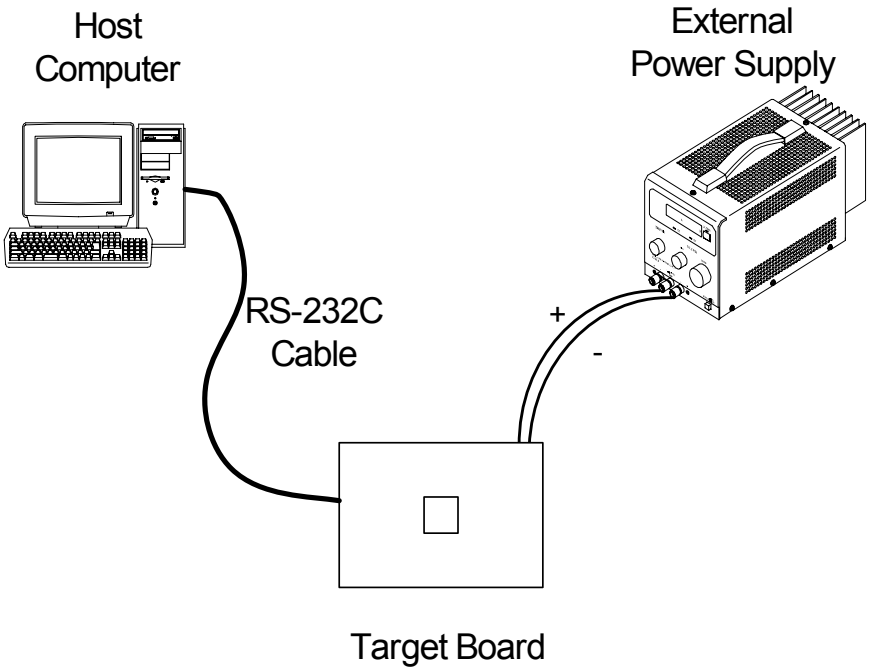


Figure 1 Connection Example with User System

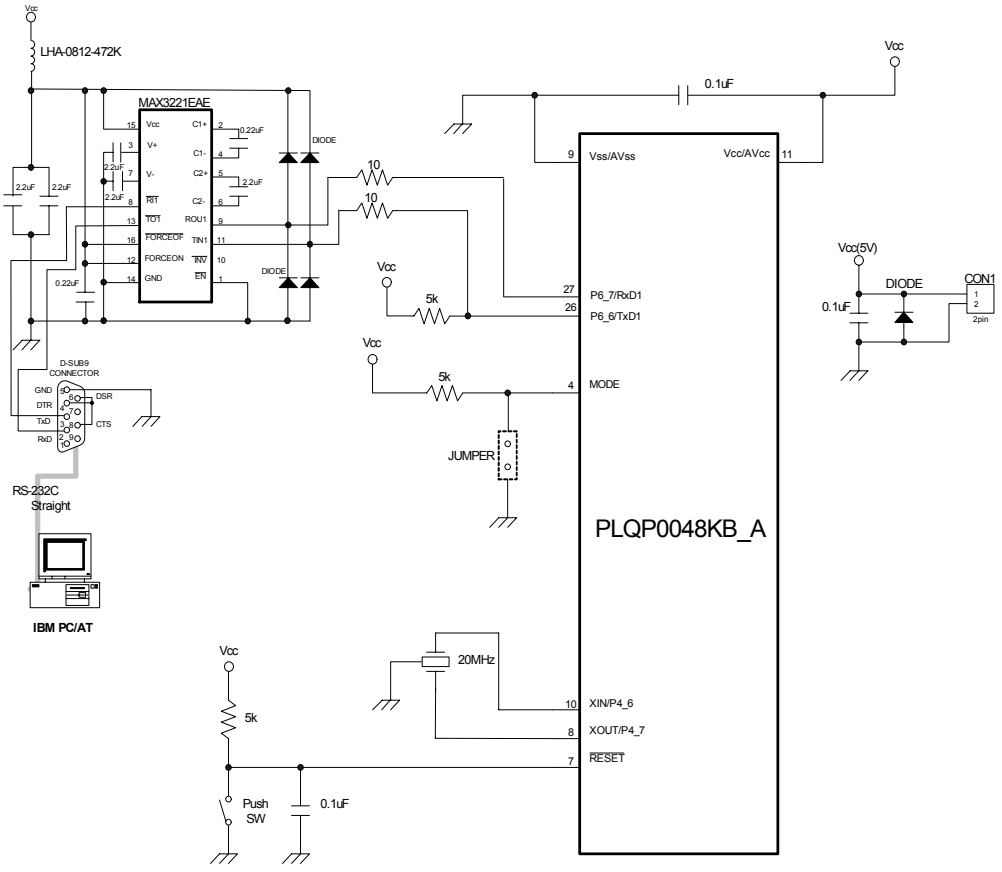


Figure 2 Circuit Example with RS-232C Cable

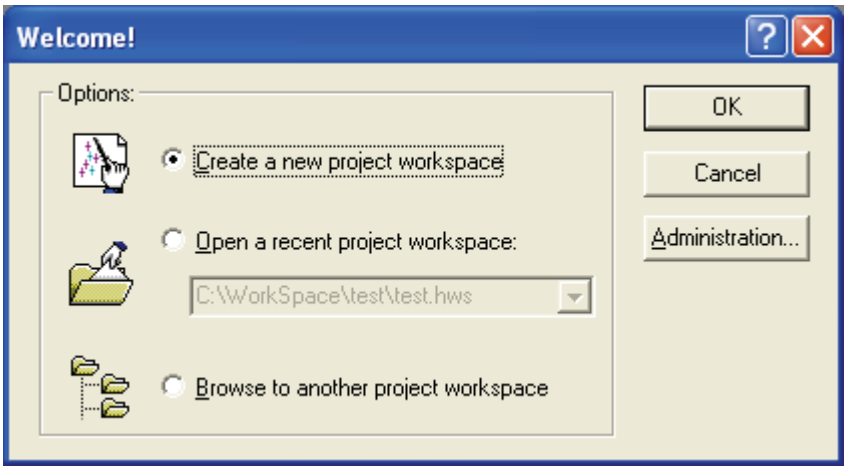
2. Prepare M16C R8C FoUSB/UART emulator debugger

In the M16C R8C FoUSB/UART debugger (R8C UART debugger), connecting a PC and the target with the RS-232C can perform debugging.

It is not necessary to prepare a monitor program for a user since it is bundled when installing the “M16C R8C FoUSB/UART debugger”

As for the R8C/Tiny, the monitor program is automatically programmed when starting the R8C UART debugger. It is not necessary to program the monitor program with the M16C FlashStarter, etc. in advance.

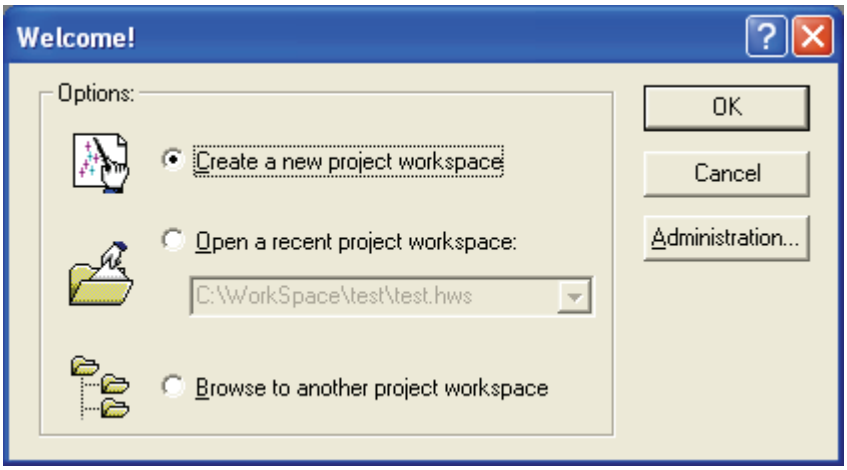
a) Start the High-performance Embedded Workshop. When clicking “Start”, “Program”, “Renesas”, “High-performance Embedded Workshop” and “High-performance Embedded Workshop”, “Welcome!” dialog is displayed.



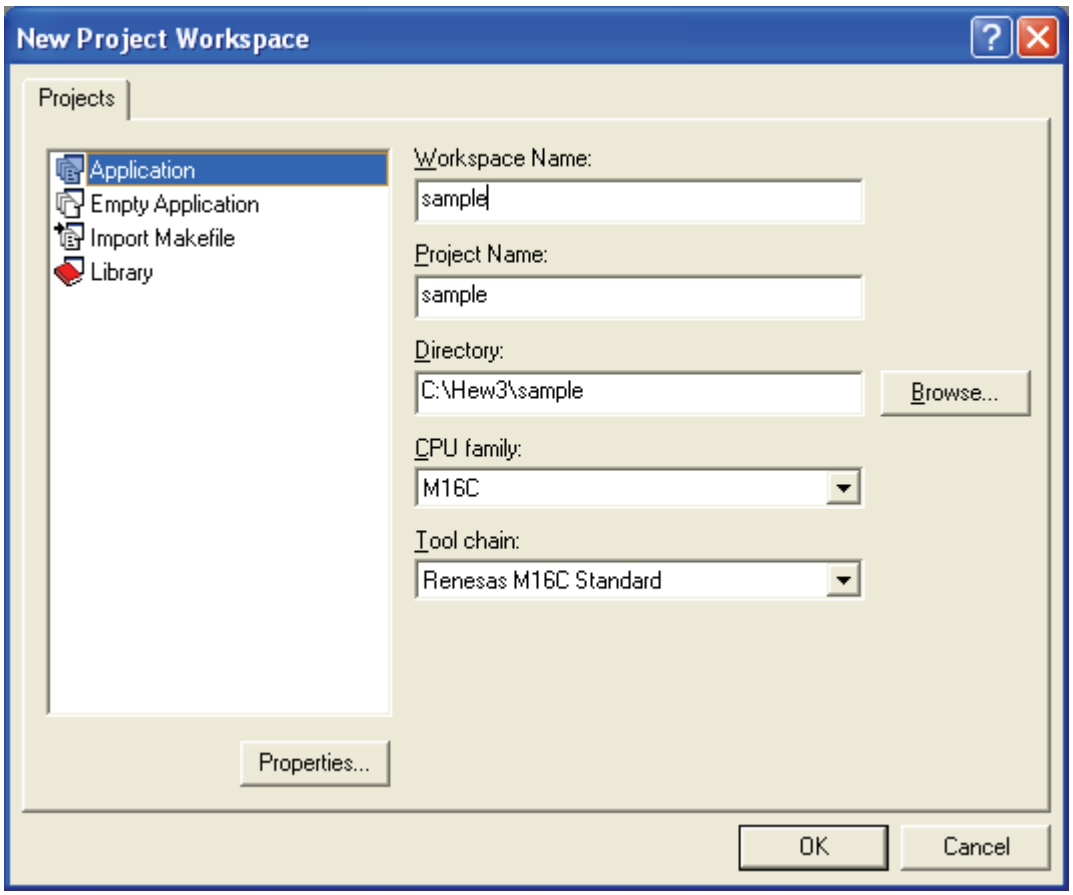
- [Create a new project work space]
  Select when creating a new workspace.
- [Open a recent project workspace]
  Select when using the existing workspace.
  Display a history in an open workspace.
- [Browse to another project workspace]
  Select when using the existing workspace
  This button is used when the open history does not remain.

When selecting the existing workspace and pushing the [OK] button, the screen of s) is displayed.

b) Select [Create a new project workspace] radio button. Push the [OK] button.



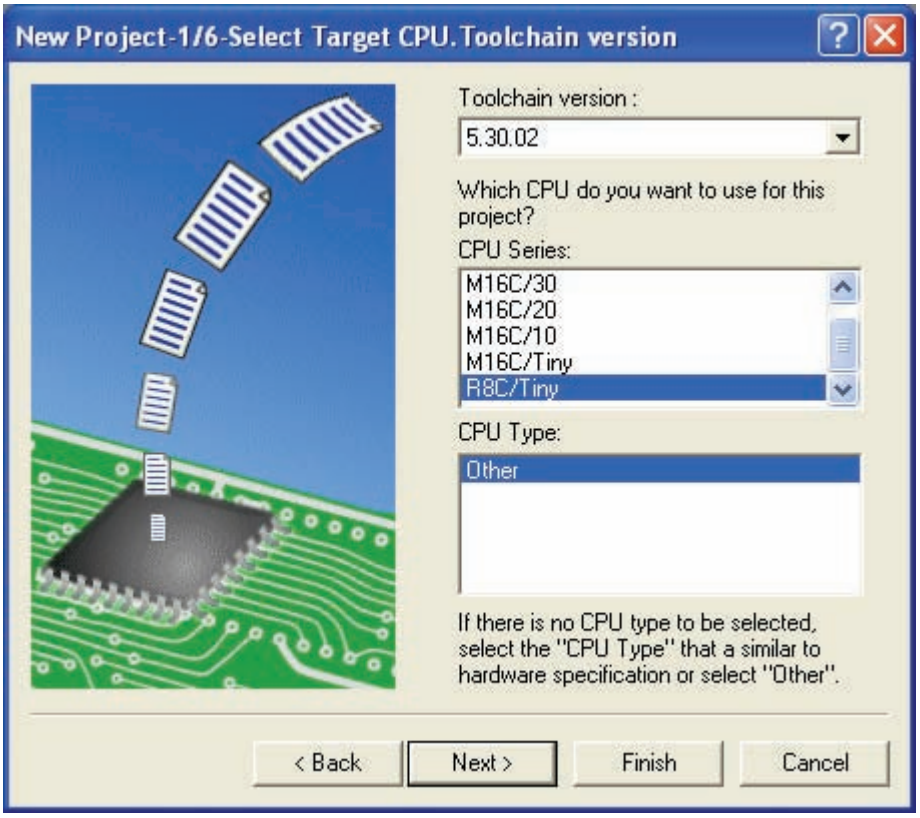
c) The Project Generator starts. When a tool chain is installed, the following screen is open.



- [Workspace name]
  Apply the workspace name newly made. “Sample” is applied as an example
- [Project name]
  If the user wants to change the project name, apply the project name.
- [CPU type]
  Select the applicable CPU type.

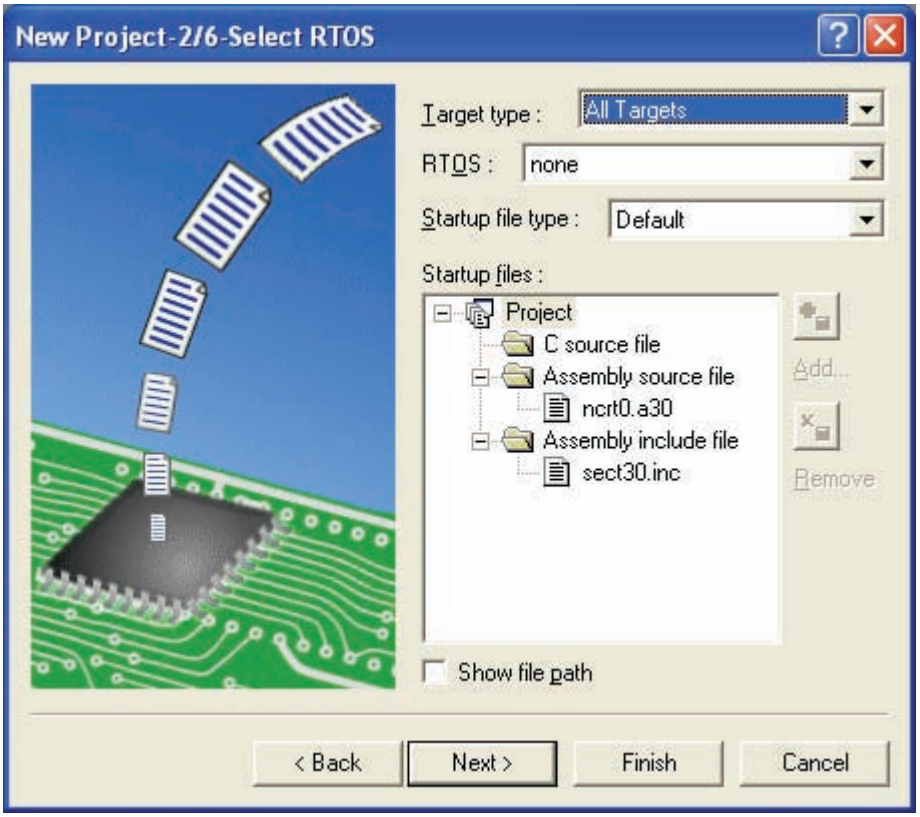
- [Tool chain]
  When using the tool chain, select the applicable tool chain name. When the tool chain is not used, select [None].
- [Project type]
  Select a project type that wants to be used.

d) Next, set the tool chain.



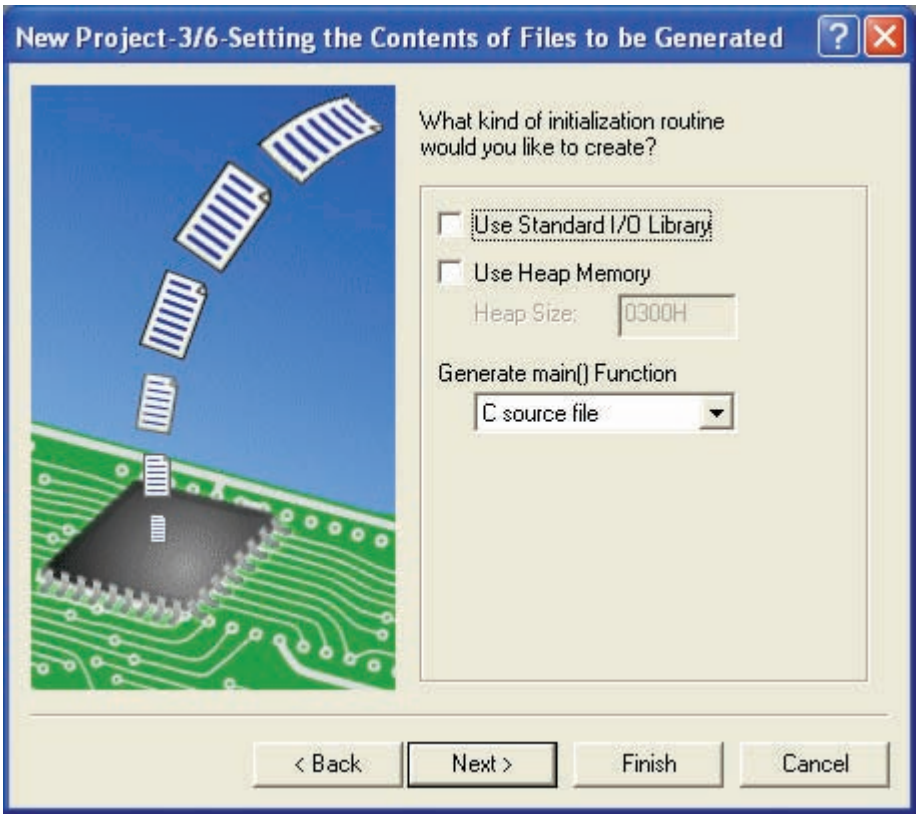
Select the tool chain version and CPU series to be used, and push the [Next] button.

e) Next, set the RTOS.



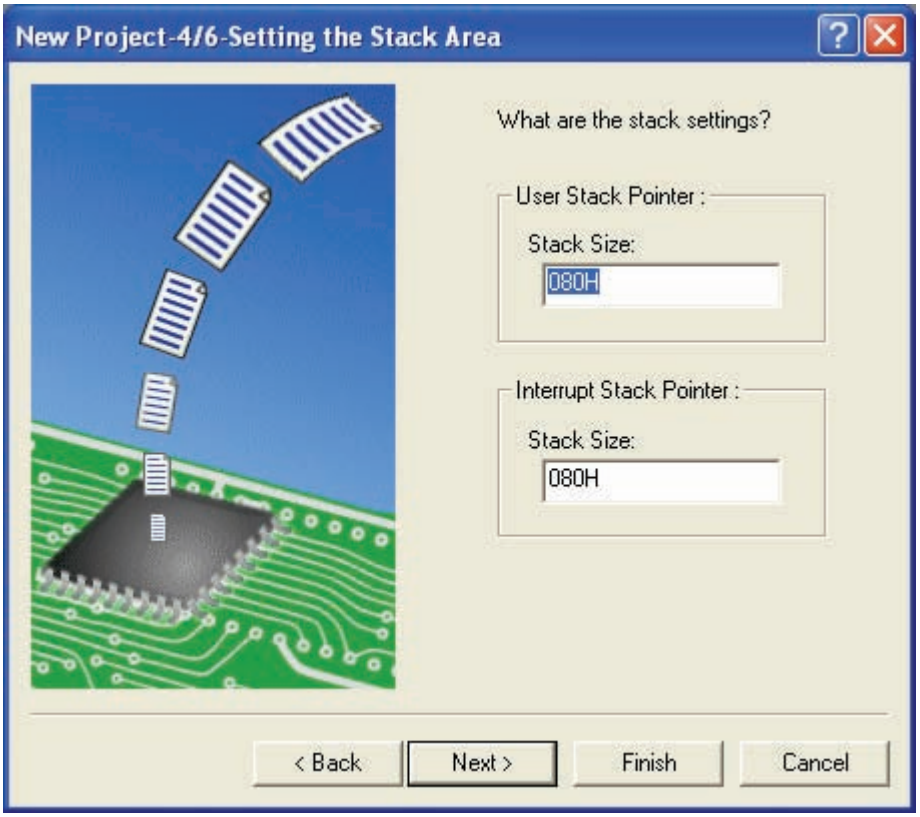
Select the RTOS and startup file type to be used, and push the “Next” button.

f) Next, set the heap area, etc.



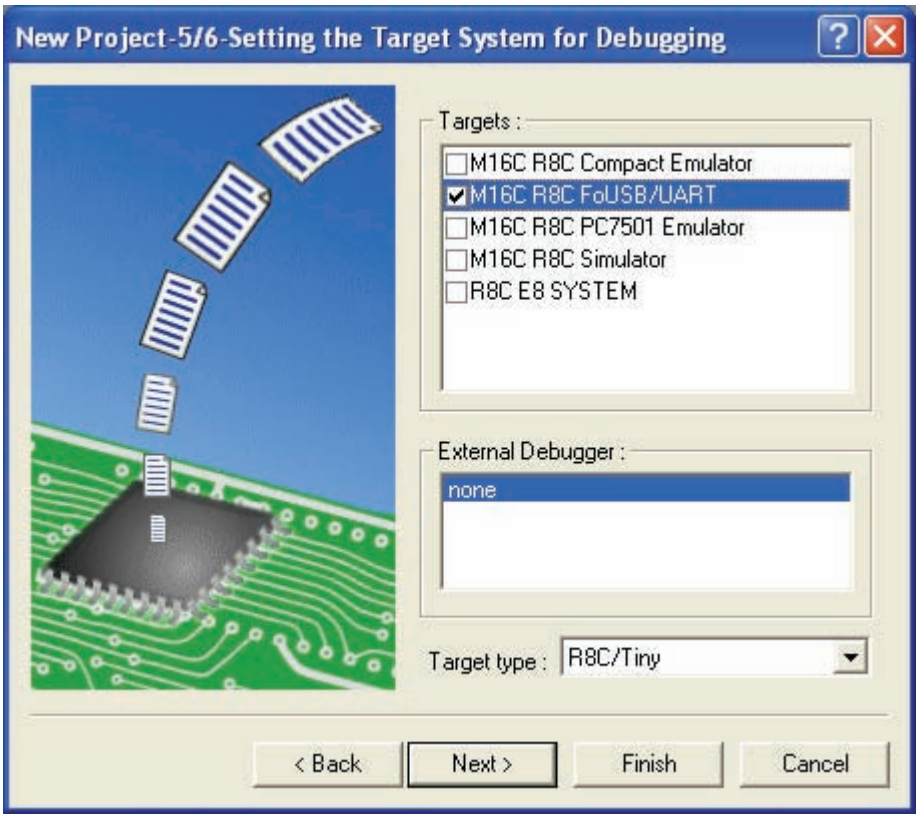
Set the heap size, etc. to be used and push the [Next] button.

g) Next, set the stack area.



Set the stack size and push the [Next] button.

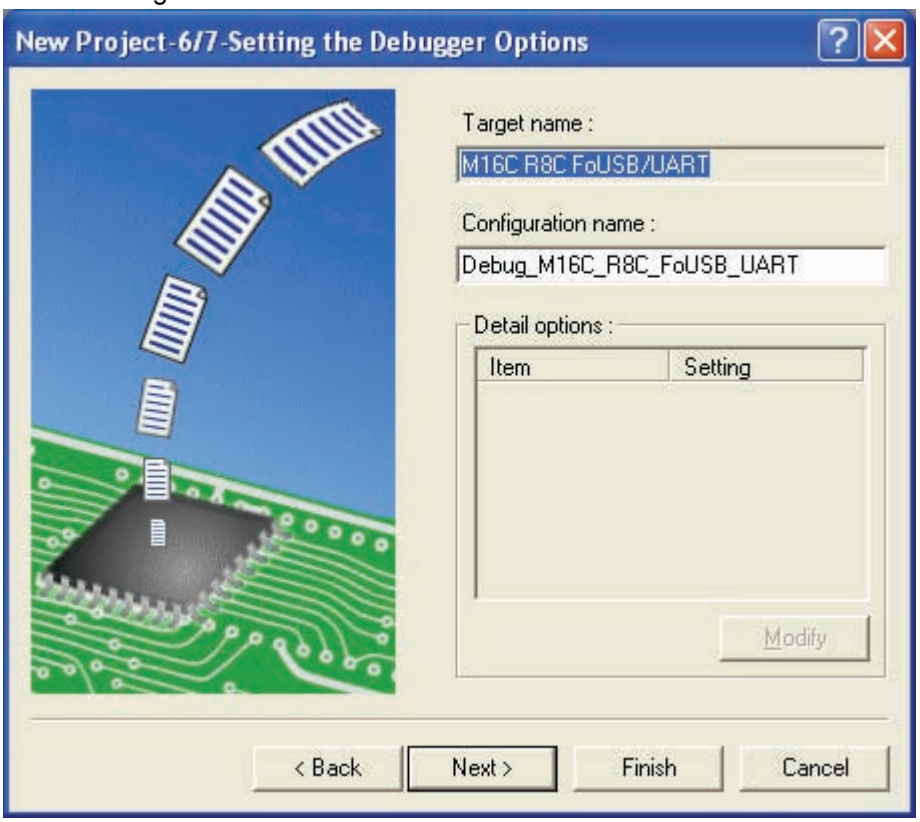
h) When the setting of the tool chain ends, the following screen is displayed.



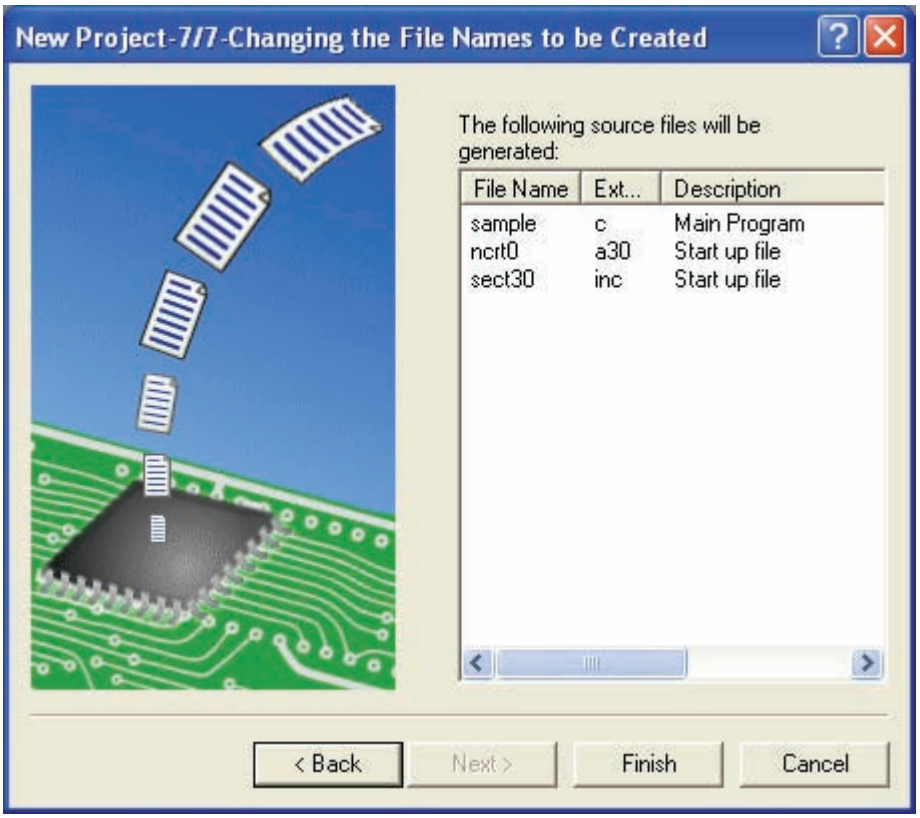
Check the M16C R8C FoUSB/UART here and push the [Next] button.
If necessary, check other products.

i) Next, set the configuration file name.

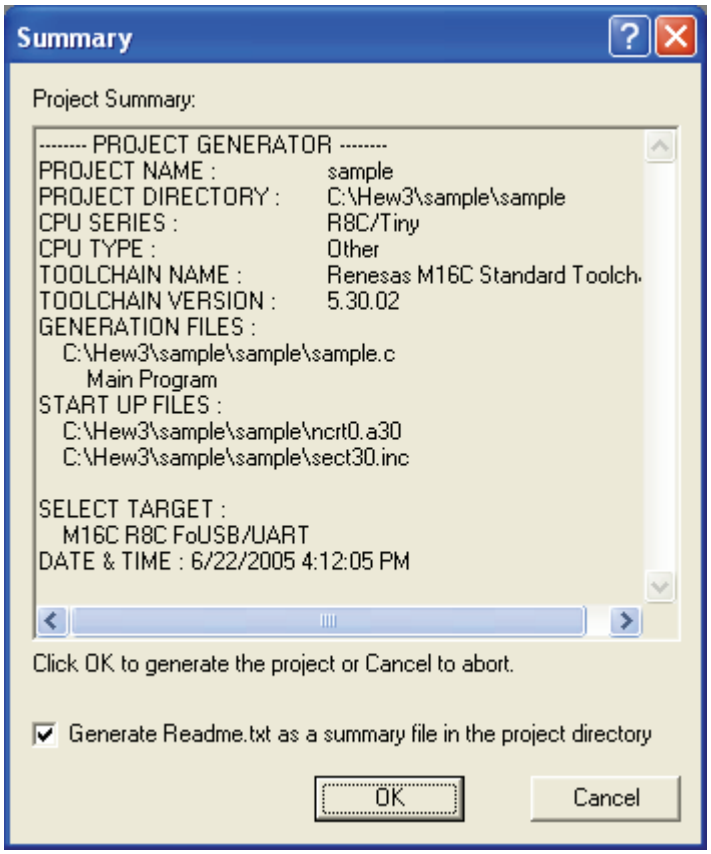
Configurations are the build option settings (e.g., output of debug information or optimization) having their own names. The term "configuration" can also be referred to as "build configuration".



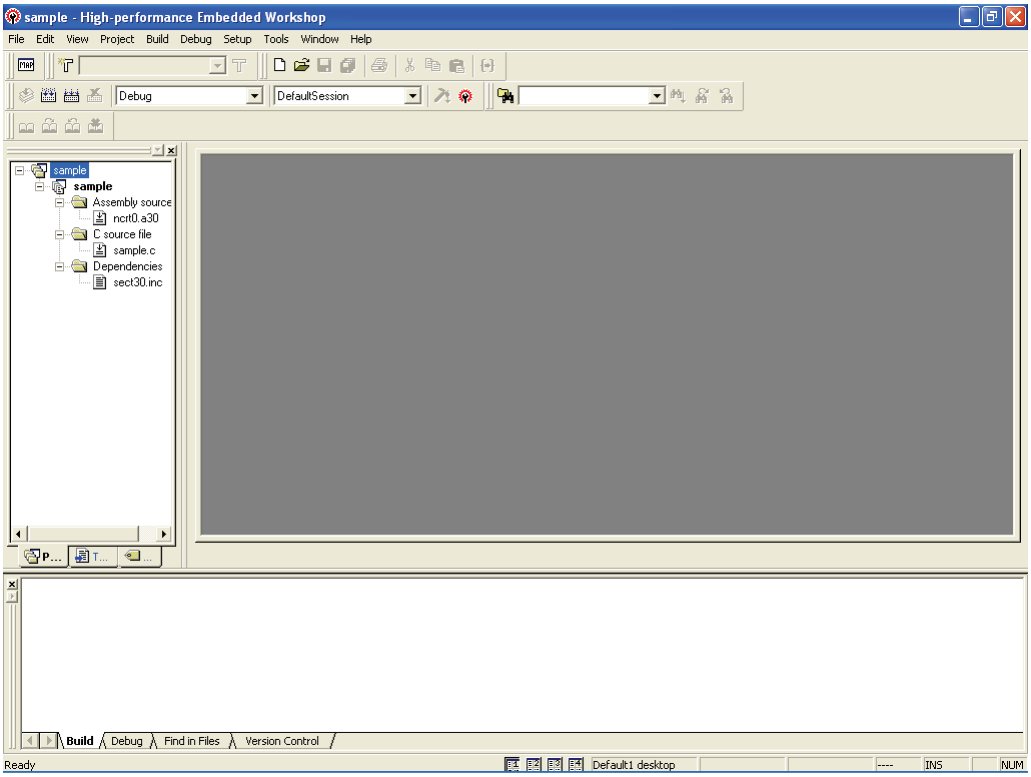
j) Finally, check the file name to be generated.



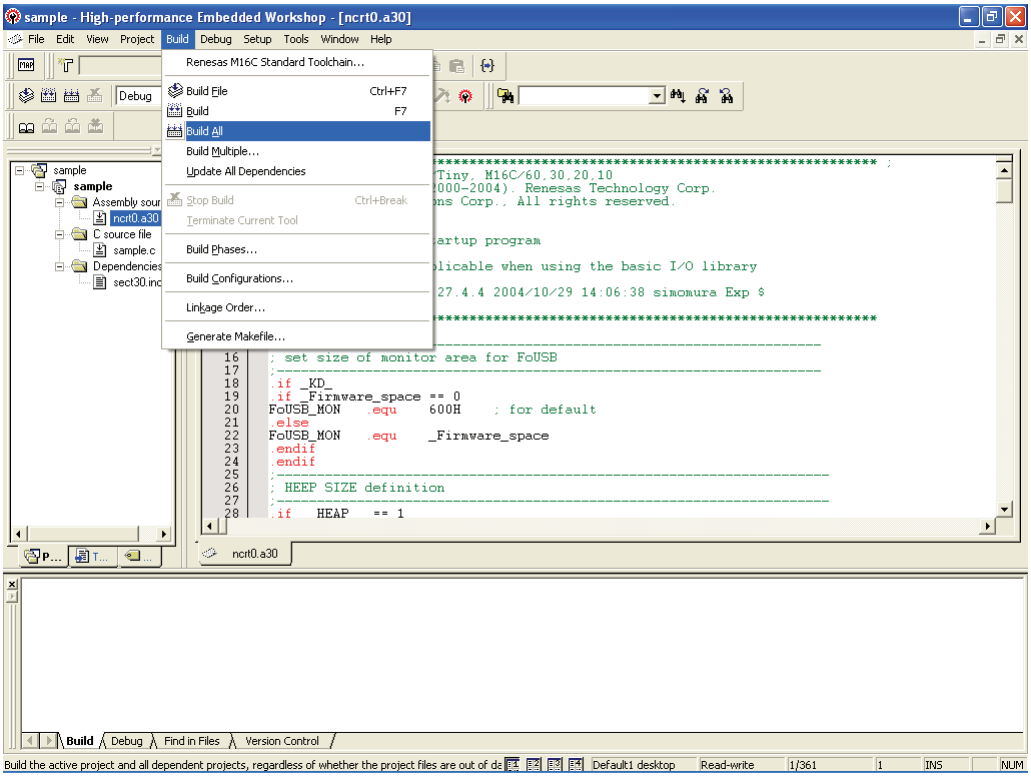
k) The above settings display the file which the High-performance Embedded Workshop generates. When pushing the [OK] button, High-performance Embedded Workshop starts.



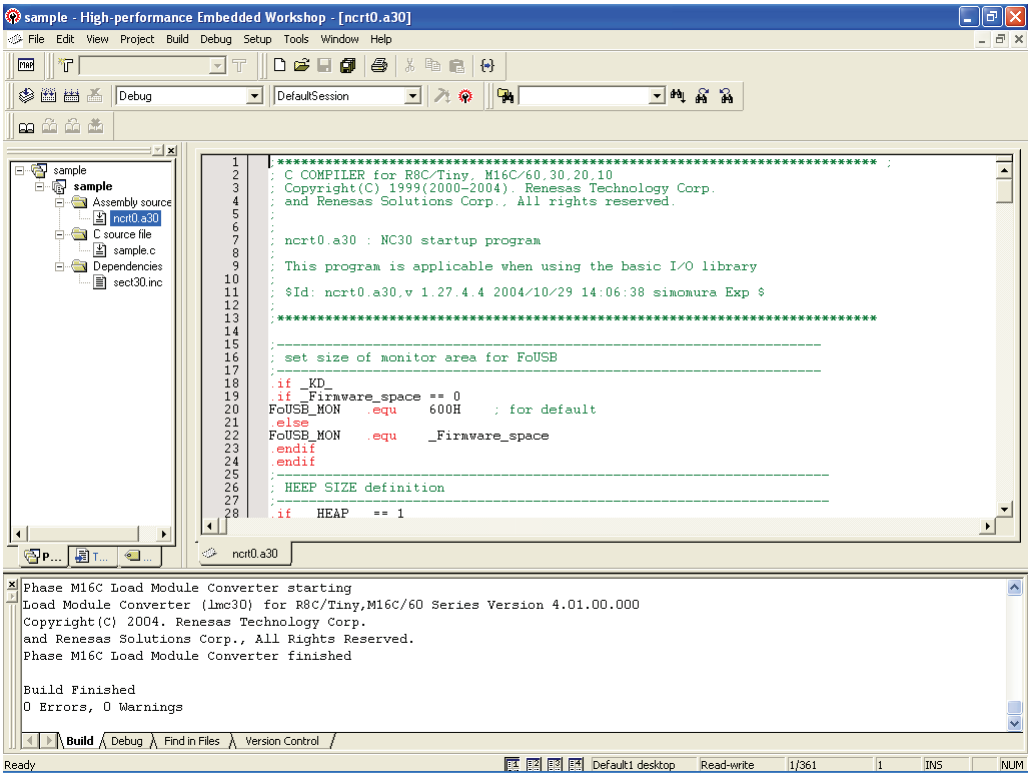
l) When double-clicking the source program, an editor starts and can be edited.



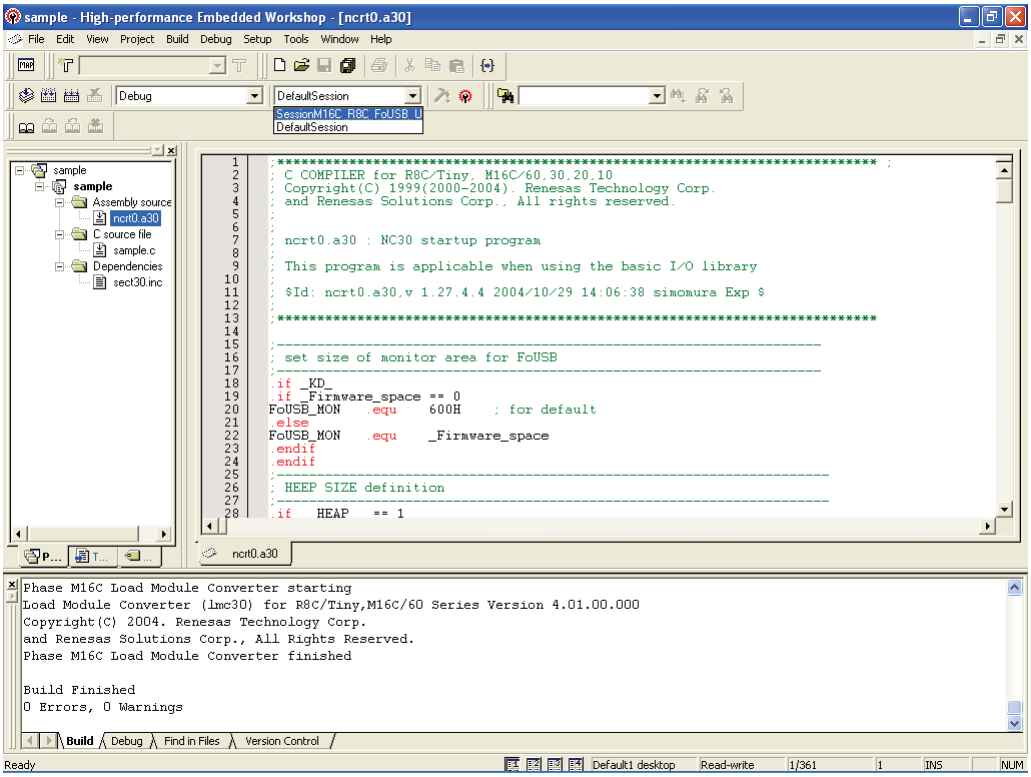
m) Clicking “Build”, and “Build” or “Build All” can build after creating a program.



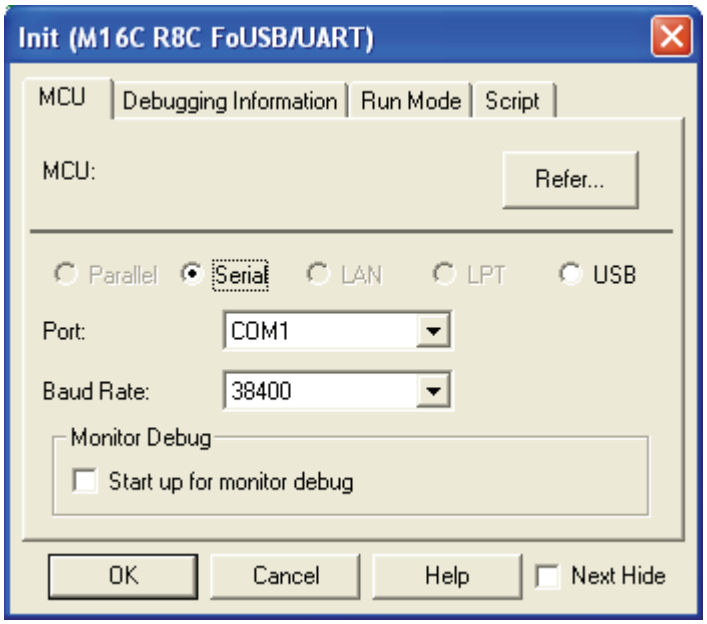
n) The result of a build is displayed.



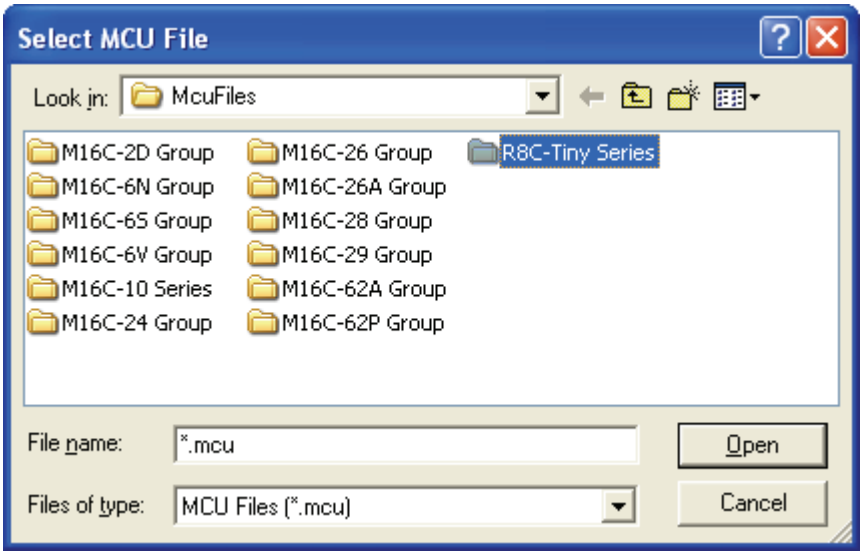
o) Next, connect with the target. Switching to the registered session file in which the setting uses the R8C UART debugger in advance can connect simply.



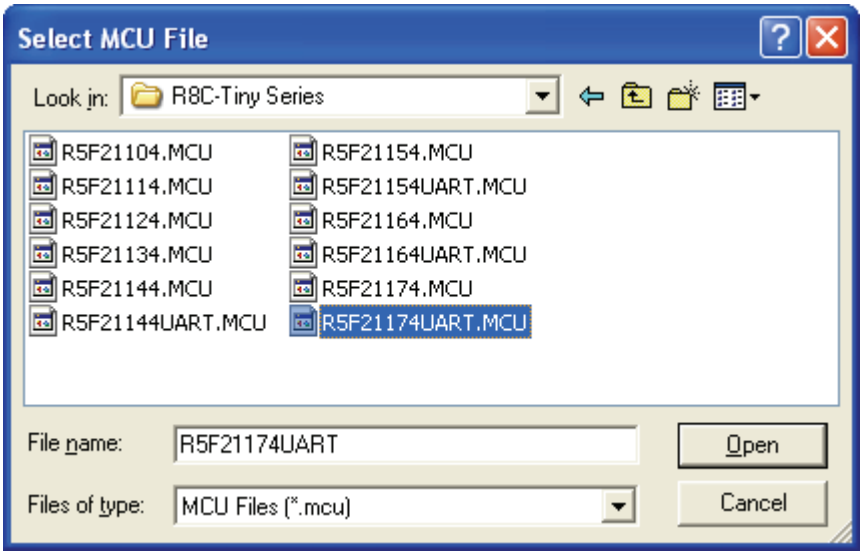
p) The Init screen is displayed. Select [Serial] radio button and push [Reference] button.



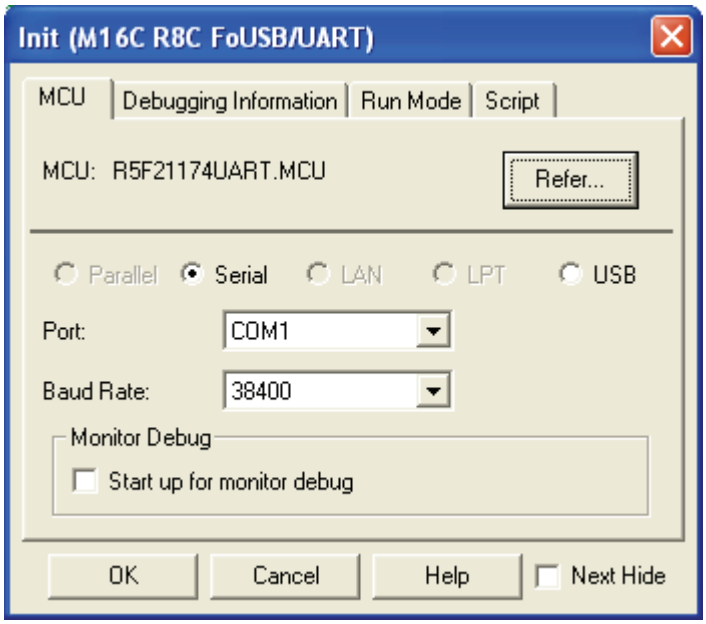
q) Select the “R8C-Tiny Series”.



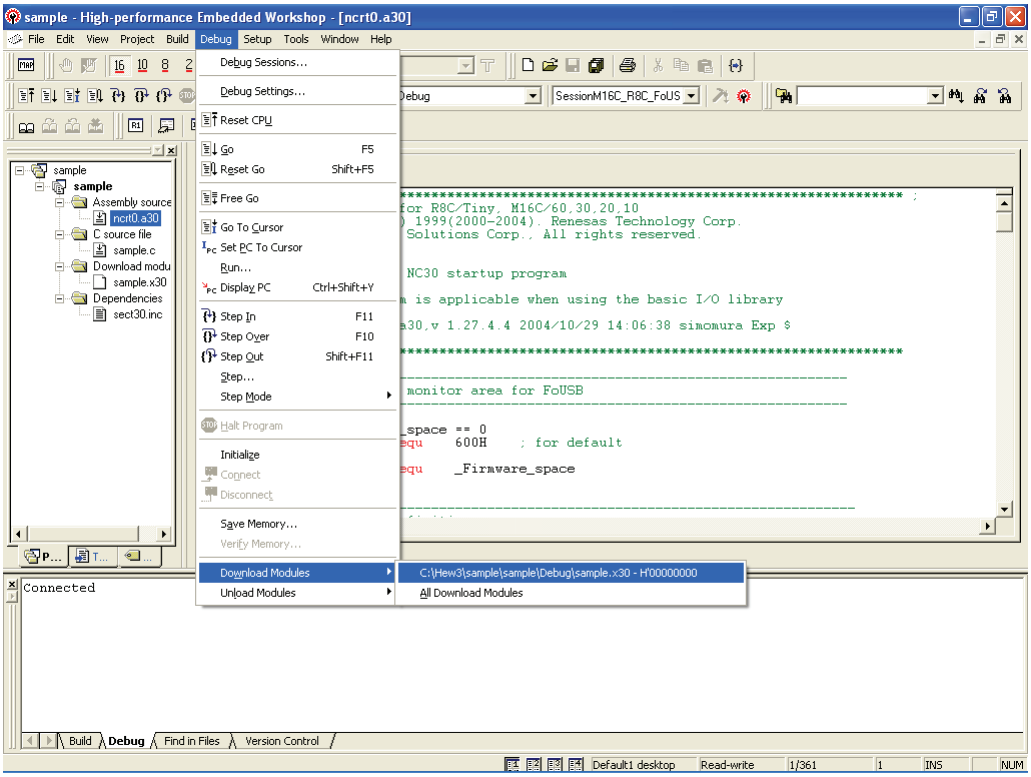
r) Select an MCU file.



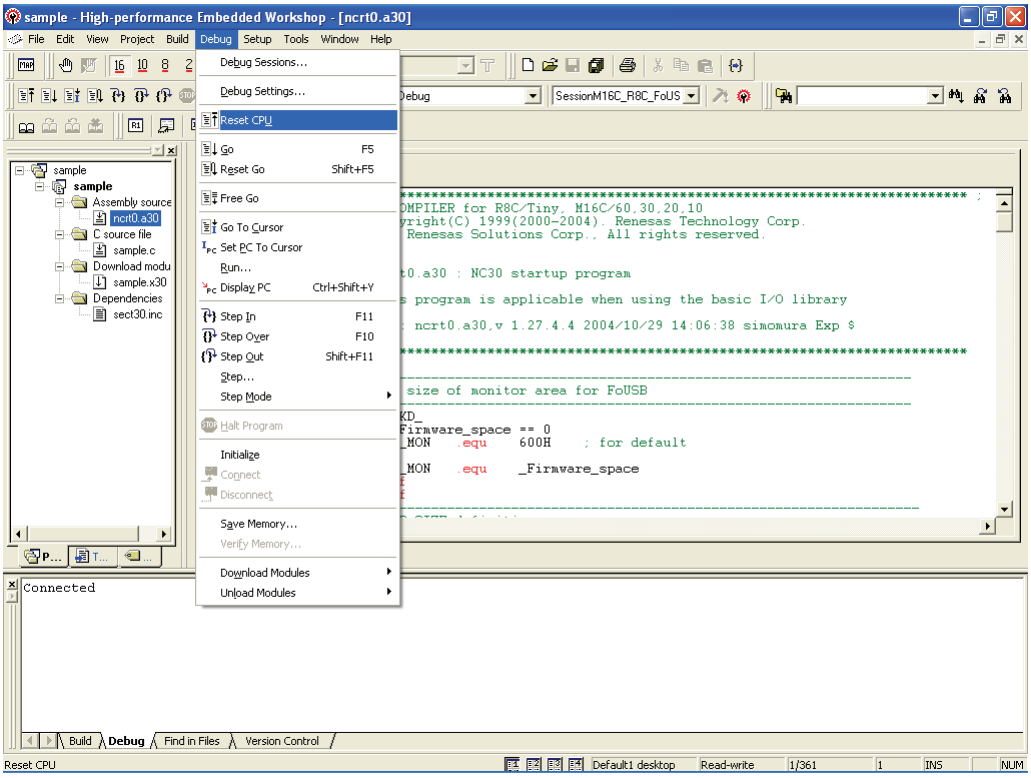
s) When pushing “OK”, a monitor program is downloaded.



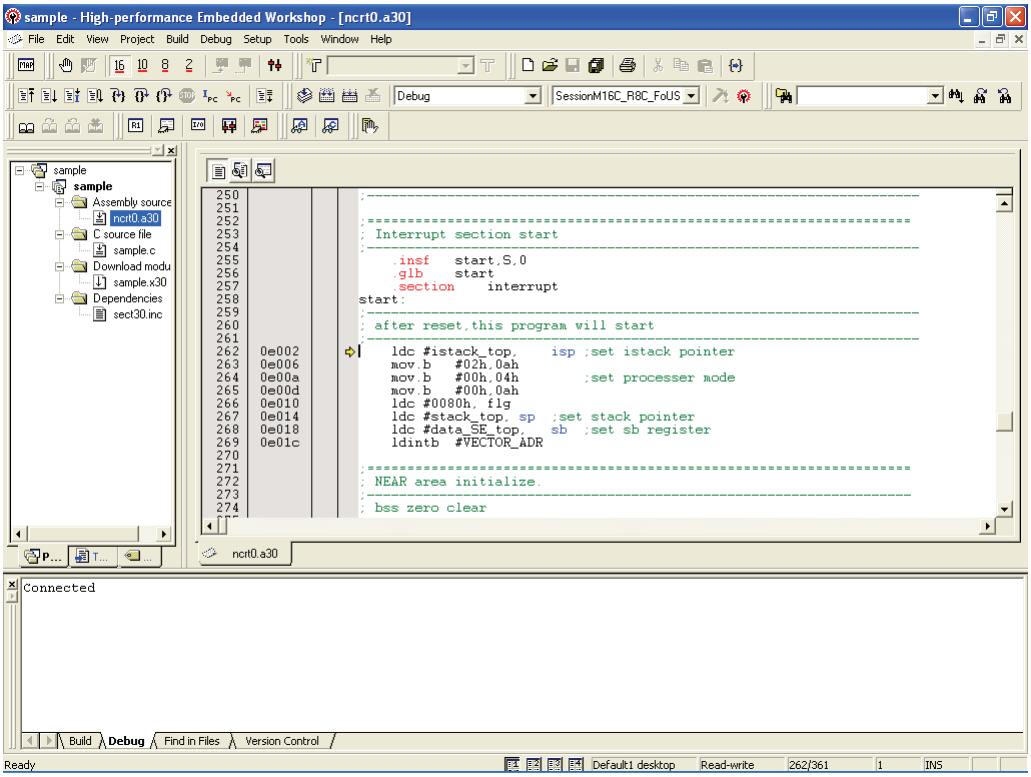
t) Download a user program with “Debug”, “Download” and “Download File (X30 file)”.



u) Clicking “Debug” and “Reset CPU” resets the user program.



v) A cursor moves to the top of the user program and a debug can start.


sample - High-performance Embedded Workshop - [ncrt0.a30]
Interrupt section start
after reset,this program will start
NEAR area initialize.
bss zero clear
Connected
Build Debug Find in Files Version Control
Ready
Default1 desktop Read-write 262/361 1 INS

3. Memory Map When Using R8C UART Debugger

Figure 3 shows the Memory Map of R8C/Tiny On-chip Flash Memory

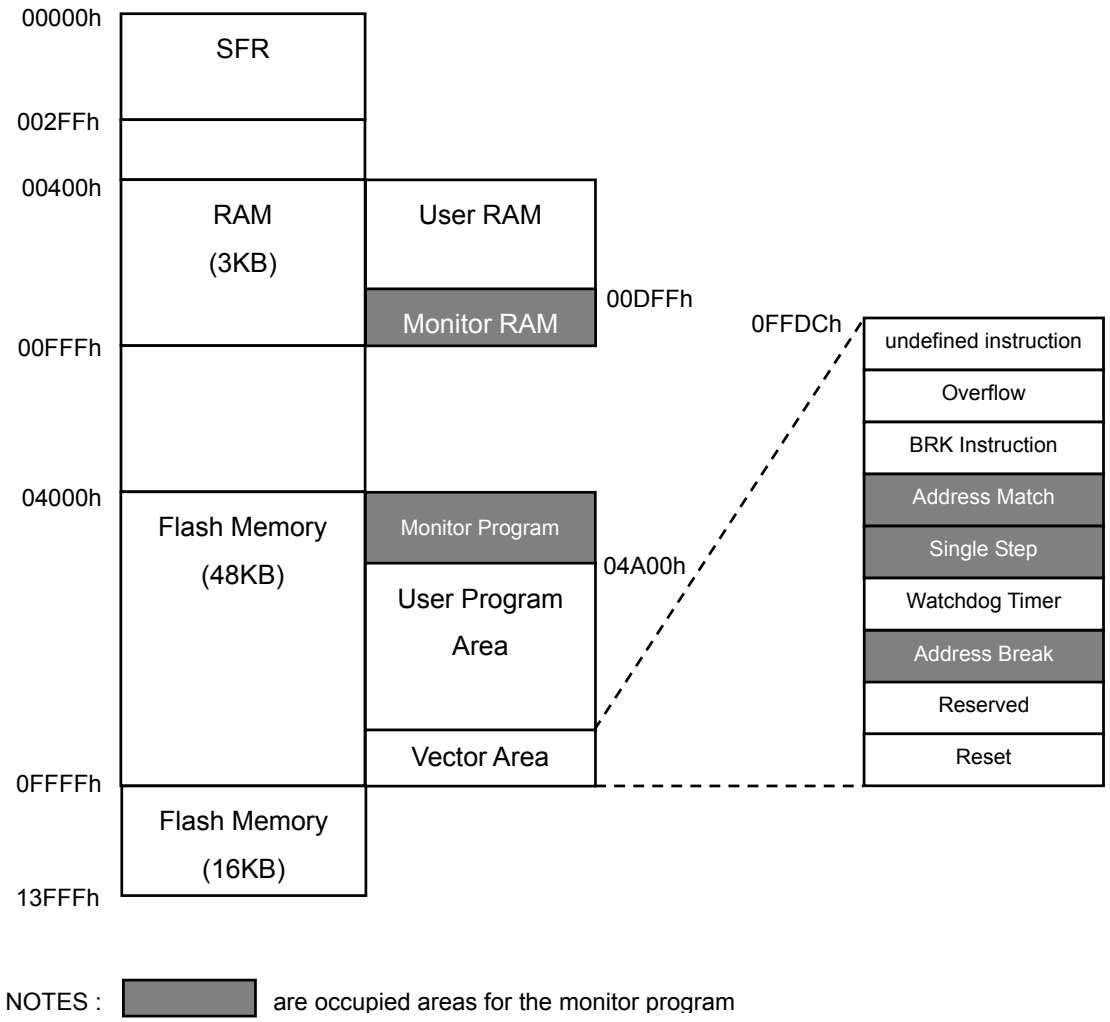


Figure 3 Memory Map of R8C/Tiny

4. Occupied Area for Monitor Program

Table 1 Occupied Area for Monitor Program

ROM / RAM	Occupied Area for Monitor Program
32KB / 2KB	Vector FFE8h to FFEBh, FFECh to FFEFh, FFF4h to FFF7h
48KB / 2.5KB	RAM DFFh Flash memory 4000h to 49FFh Vector FFE8h to FFEBh, FFECh to FFEFh, FFF4h to FFF7h
64KB / 3KB	RAM DFFh to FFFh Flash memory 4000h to 49FFh Vector FFE8h to FFEBh, FFECh to FFEFh, FFF4h to FFF7h

5. Precautions on Using R8C UART Debugger

5.1. When changing the communication speed and restarting the R8C UART debugger after the R8C UART debugger ends.

The target MCU holds the baud rate value after the R8C UART debugger ends. Therefore, when changing the communication speed and restarting the R8C UART debugger, a communication error occurs. (The R8C UART debugger can be started when using the previous communication speed). When changing the communication speed, turn off the target power and turn on the power again.

5.2. ID code of user program

Set the ID code of the user program to **all FFh** when using the R8C UART debugger.

Table 2 Storing Address of ID Code (R8C/10 Group)

Address	ID No.	Vector Table
0FFDFh – 0FFDCh	ID1	Undefined Instruction
0FFE3h – 0FFE0h	ID2	Overflow
0FFE7h – 0FFE4h		BRK Instruction
0FFEBh – 0FFE8h	ID3	Address Match
0FFEFh – 0FFECh	ID4	Single Step
0FFF3h – 0FFF0h	ID5	Watchdog Timer, Oscillation Stop Detection, Voltage Monitor 2
0FFF7h – 0FFF4h	ID6	Address Break
0FFFBh – 0FFF8h	ID7	Reserved
0FFFFh – 0FFFCh	(NOTES 1)	Reset

NOTES

1. Refer to the hardware manual for the value set in 0FFFFh.

5.3. Area in which user program can be downloaded

As shown in Figure 3, a part of RAM or Flash Memory is used for the monitor program when using the R8C UART debugger. The R8C UART debugger does not download the user program in the area which overlaps with a monitor program when a user program overlaps with a monitor program. Note that the R8C UART debugger does not perform an error output at this time.

5.4. Frequency characteristics

The monitor program operates in the range of the main clock (Xin) frequency which is shown below. Use an oscillator which has this range of the frequency since the monitor program may not operate with the frequency other than the following.

1MHz (Min.) to 20MHz (Max.)

Table 3 lists each frequency and communication available speed. However, note that operation may not be performed when dividing the main clock and using it with 1MHz or below even in the range of frequency shown above.

Table 3 Communication Available Speed of Each Frequency

Frequency	Communication Speed (bps)					
	1200	2400	4800	9600	19200	38400
20MHz	N/A	N/A	√	√	√	√
16MHz	N/A	N/A	√	√	√	√
14MHz	N/A	N/A	√	√	√	√
12MHz	N/A	N/A	√	√	√	√
10MHz	N/A	√	√	√	√	√
8MHz	N/A	√	√	√	√	√
6MHz	N/A	√	√	√	√	√
4MHz	√	√	√	√	√	N/A
2MHz	√	√	√	√	N/A	N/A
1MHz	√	√	√	N/A	N/A	N/A

√ : Communication available

N/A : Communication not available

NOTES:

A communication may not be performed depending on the conditions of temperature or voltage. In this case, use the R8C UART debugger with the lowered communication speed.

5.5. Limitations on SFR operation

Table 4 lists the limitations on a register operation. Also, the monitor program does not operate properly when the register to which the change is disabled is changed.

Table 4 Limitations on SFR Operation

Register	Default Value	Limitation	Change
Processor Mode Register 0	Reset to 00h	Single-chip mode only	*
Processor Mode Register 1	Reset to 00h	————————	√
System Clock Control Register 0	Reset to 08h	Set the CM05 bit to "0".	*
System Clock Control Register 1	Reset to 28h	Set the CM13, CM15 bit to "1".	*
High-Speed On-Chip Oscillator Control Register 0	Reset to 03h	————————	√
High-Speed On-Chip Oscillator Control Register 1	————————	————————	√
High-Speed On-Chip Oscillator Control Register 2	Reset to 03h	————————	√
Oscillation Stop Detection Register	Reset to 00h	————————	N/A
Protect Register	————————	————————	√
Flag Register	————————	Writing to the D flag is ignored Do not set to "1".	*
ISP (Interrupt Stack Pointer)	Reset to 057Fh	Set the value of 06FFh or below. 06FFh to 07FFh are used for the monitor program..	*
UART 1 Transmit/Receive Mode Register	15h	Do no change.	N/A
UART 1 Bit Rate Register	————————		
UART 1 Transmit/Receive Control Register 0	00h		
UART 1 Transmit/Receive Control Register 1	07h		
UART 1 Function Selection Register	————————		
Port Mode Register	10h		
UART 1 Transmit Buffer Register	————————	Do not write data to this register.	N/A
UART 1 Receive Buffer Register	————————	Do not write data to this register.	N/A

√: Possible to change N/A: Disable to change *: Possible to change (Limitations in part)

5.6. Limitations on stop mode or wait mode

When using stop mode or wait mode on a user program, start the R8C UART debugger in free-run mode, and close a RAM window, C watch window and an ASM window in advance. Also, do not operate the R8C UART debugger until the program stops at the break point by setting the break point after exiting stop mode or wait mode.

5.7. Watchdog timer

The watchdog timer is refreshed while the monitor program operates. If the monitor program operates by referring or changing memory contents during the user program execution which uses the watchdog timer, note that the watchdog timer will be refreshed.

5.8. Real-time operation of user program

- Sampling Run (Sampling) Mode

In sampling mode, the execution status of the user program will be monitored regularly when executing Go and Come. Therefore, the stop of the user program by a break can be detected. Select this mode when performing normal debug.

- Free Run (free run) mode

In free fun mode, the execution status of the user program will not be monitored when executing Go and Come. The stop of the user program by a break cannot be detected although real-time operation of the user program can be guaranteed. Therefore, even the user program stops, the R8C UART debugger does not stop executing Go and Come. Push the STOP button to stop the R8C UART debugger.

NOTES:

In free run mode, use the R8C UART debugger while the RAM window, C watch window and ASM window are closed.

5.9. Exceptional step execution

• Software interrupt instruction

The step execution cannot be performed continuously for the instruction internal process of the instructions (undefined instruction, overflow, BRK instruction and INT instruction) which generate the software interrupts.

Example) INT instruction

```
        NOP
        NOP
        INT     #3          ↓  Break point is skipped over
        NOP                    when performing step execution
        JMP     MAIN
INT_3:
        NOP     ←          Address at which program
        NOP                execution ought to stop
        NOP
        REIT
```

• INT instruction

Set the software break for the INT instruction internal process and use the Go command to debug the program using the INT instruction.

Example)

```
        NOP                          ↓
        INT     #3                   Execute by Go command
        NOP                          ↓
        JMP     MAIN                 ↓
INT_3:  ←                            ↓
        NOP                  Break
        NOP
        REIT
```

5.10. Limitations on peripheral functions

UART1 is used for a communication of the monitor program and the host computer. Do not use UART1 for a user program.

Also, the following pins should be used for a communication with the host computer. Do not connect to other pins, etc.

- R8C/20-23 Groups

  TxD1 (26pin), RxD1 (27pin)

5.11. Limitations on flag register

When operating the flag register on the user program, execute the **FSET instruction and FCLR instruction** not to change the debug flag (D flag).

5.12. Operation on peripheral I/O during break

Although an interrupt cannot be acknowledged during a break, the peripheral I/O continues operating. For example, when stopping the user program by a break after operating a timer, the timer continues counting, but the timer interrupt cannot be acknowledge.

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Precautions on Connecting R8C/20, R8C/21, R8C/22, R8C/23

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